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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/577,733

05/02/2006

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36-1988

5171

23117 7590 11/12/2008
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EXAMINER

DRENNAN, BARRY T

ART UNIT

PAPER NUMBER

4133

MAIL DATE

DELIVERY MODE

11/12/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/577,733	Applicant(s) XU ET AL.	
	Examiner Barry Drennan	Art Unit 4133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 May 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/14/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

1. This application claims benefit under the Patent Cooperation Treaty as a national stage application of International Application PCT/GB04/04687, filed 8 November 2004. This application also claims foreign priority of application GB 0326375.3 filed in the United Kingdom on 12 November 2003.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: "Object tracking within video images based on blob object models using Mahalanobis distance and Kalman filter".

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: All of the instances of the form "step x.xx" in the specification are instead labeled "S.x.xx" in the drawings. The reference characters must match fully. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to modify the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures

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appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1-11 are rejected under 35 U.S.C. 101 because they do not fall within one of the four statutory categories of invention. While the claims recite a series of steps or acts to be performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing. The instant claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process. In order for a process to be "tied" to another statutory category, the structure of another statutory category should be positively recited in a step or steps significant to the basic inventive concept, and not just in association with statements of intended use or purpose, insignificant pre- or post-solution activity, or implicitly.

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6. Claim 12 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claim 12 defines “a computer program or a suite of computer programs” embodying functional descriptive material (i.e., a computer program or computer executable code). However, the claim does not define a “computer-readable medium or computer-readable memory” and is thus non-statutory for that reason (i.e., “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized” – Guidelines Annex IV).

The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus not able to impart any functionality of the recited program. The examiner suggests amending the claim to embody the program on “computer-readable medium” or equivalent. Any amendment to the claim should be commensurate with its corresponding disclosure.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-4 and 12-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Park, et al., “Segmentation and Tracking of Interacting Human Body Parts under

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Occlusion and Shadowing”, Proc. Workshop on Motion and Video Computing, pp. 105-111 (published 5 December 2002, hereinafter Park).

9. With respect to claim 1, Park discloses a method for tracking objects in a sequence of video images, comprising the steps of:

storing object models relating to objects detected in previous video images of the sequence, the object models comprising values of characteristic features of the detected objects and variances of those values (implicit in the formation of blob-based object models and subsequent processing of those models for object tracking, section III);

receiving a further video image of the sequence to be processed (implicit in the tracking of blobs throughout a video image, section III);

detecting objects in the received video image (“A Gaussian mixture model is used to classify individual pixels.... Markov Random Field framework is used at the blob level to merge the pixels.... The blobs are then grouped to form the meaningful body parts by a simple body model,” section I);

determining characteristic features of the detected objects (unary, binary, and tertiary features listed in section III.B);

calculating a distance measure between each detected object and each object model on the basis of the respective characteristic features using a distance function which takes into account at least the variance of the characteristic features (Eq. 9, 10, 11);

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matching the detected objects to the object models on the basis of the calculated distance measures (Fig. 3); and

updating the object models using the characteristic features of the respective detected objects matched thereto (Fig. 5).

10. With respect to claim 2, Park discloses the method according to claim 1, wherein the distance measure is a scaled Euclidean distance (Eq. 9, 10, 11).

11. With respect to claim 3, Park discloses the method according to claim 2, wherein the distance function is of the form:

$$D(l, k) = \sqrt{\sum_{i=1}^N \frac{(x_{li} - y_{ki})^2}{\sigma_i^2}}$$

for object model l and detected object k , where x_{li} and y_{ki} are values of the characteristic features of a stored object model and a detected object respectively, σ_i^2 is the corresponding component of the variance of each feature, and the index i runs through N features of an object model (mathematically equivalent to Eq. 11).

12. With respect to claim 4, Park discloses the method according to claim 1, wherein the distance measure is the Mahalanobis distance (Eq. 11).

13. Claims 12 and 13 are rejected for the same reasons set forth in the rejection of the corresponding method in claim 1.

14. Claims 14-17 are rejected for the same reasons set forth in the rejection of the corresponding method in claims 1-4, respectively.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claims 5 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claims 1 and 14 above, respectively, and further in view of Marcenaro et al., "Multiple Object Tracking under Heavy Occlusions by Using Kalman Filters Based on Shape Matching," Proc. 2002 Int'l. Conf. on Image Processing, Vol. 2 pp. 341-344 (published 22 September 2002, hereinafter Marcenaro).

17. With respect to claim 5, Park discloses the limitations of claim 1, but does not disclose predicting the values of characteristic features of object models for the received frame.

However, Marcenaro discloses using a Kalman filter, which predicts the values of characteristic features and then uses those feature predictions to update the object models (section 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the application of

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the Kalman filter as disclosed by Marcenaro, motivated by the reduction in sensitivity to noise that the Kalman filter provides, a property of Kalman filters that is well known in the art.

18. Claim 18 is rejected for the same reasons set forth in the corresponding method in claim 5.

19. Claims 6 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claims 1 and 14 above, respectively, and further in view of Harville, U.S. Patent 7,003,136 B1 (filed as application 10/133,151 on 26 April 2002, hereinafter Harville).

20. With respect to claim 6, Park discloses the limitations of claim 1, but does not disclose increasing the variances of characteristic feature values when an object model is not matched to a detected object.

However, Harville discloses incrementing the state variances when no detected object is matched to an object model (col. 14, lines 17-22).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the increase in state variances disclosed by Harville, motivated by the need to decrease the level of tracking confidence for the person (Harville, col. 14 lines 20-21) and to accommodate a larger valid area for reacquiring the tracked object.

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21. Claim 19 is rejected for the same reasons set forth in the corresponding method in claim 6.

22. Claims 7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claim 1 and 14 above, respectively, and further in view of Magarey, U.S. Patent 7,177,446 B2 (filed as application 10/207,140 on 30 July 2002, hereinafter Magarey (Patent)).

23. With respect to claim 7, Park discloses the limitations of claim 1, but does not disclose updating the characteristic feature values with the average values found over a predetermined number of previous images whenever the object model is not matched with a detected object.

However, Magarey (Patent) discloses updating reference data with the average of feature vectors of prior frames when determining that the track of the feature has been lost (col. 16 lines 1-5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the average value update of Magarey (Patent), motivated by the need to update the tracked object with a feature vector representative of its past behavior in order increase the likelihood of reacquiring tracking at a later time.

24. Claim 20 is rejected for the same reasons set forth in the corresponding method in claim 7.

25. Claims 8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claim 1 and 14 above, respectively, and further in view of Senior et al., "Appearance Models for Occlusion Handling", Proc. 2nd IEEE Int'l. Workshop on Performance Valuation of Tracking and Surveillance, pp. 108-115 (published 9 December 2001, hereinafter Senior).

26. With respect to claim 8, Park discloses the limitations of claim 1, but does not disclose considering an object to be occluded if an overlap with another object is detected.

However, Senior discloses the determination of occlusion when objects overlap (Fig. 4, 5, and section 6), and further describes the resolution of such occlusion determinations.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the occlusion resolution of Senior, motivated by the increased accuracy of tracking when the tracking process can distinguish at least partially from among overlapping objects, a necessity when dealing with real world scenarios (Senior, abstract and section 1).

27. Claim 21 is rejected for the same reasons set forth in the corresponding method in claim 8.

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28. Claims 9 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claim 1 and 14 above, respectively, and further in view of Lo, et al., U.S. Patent 5,109,435 (issued 28 April 1992, hereinafter Lo).

29. With respect to claim 9, Park discloses the limitations of claim 1, but does not disclose outputting a signal to indicate that an object has been tracked for a certain number of frames.

However, Lo discloses setting an acquisition flag when an object has been tracked for at least three frames (col. 6 lines 55-57) which is then provided as an output (Fig. 3, output from element 26).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the acquisition signal of Lo, motivated by the desire to interface with external devices which can act on the presence of the acquisition signal (e.g., by providing line of sight rates, object image growth rates, etc.; Lo, col. 6 line 64 through col. 7 line 2).

30. Claim 22 is rejected for the same reasons set forth in the corresponding method in claim 9.

31. Claims 10 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claim 1 and 14 above, respectively, and further in view of Magarey, Patent Application Publication 2003/0053661 (published 20 March 2003, hereinafter Magarey (PgPub)).

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32. With respect to claim 10, Park discloses the limitations of claim 1, but does not specifically disclose deleting the object model when the object has not been tracked for a number of consecutive frames.

However, Magarey (PgPub) discloses ending a tracking process once the tracked object has not been detected for a predetermined number of consecutive frames, with the implication that the object model is subsequently deleted.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the tracking process termination of Magarey, motivated by the increased efficiency in terms of memory and processor time that arises as a result of not continuing to track objects which have been determined to have likely left the field of view, as well as the ability to continue tracking objects which may have only temporarily become occluded or otherwise undetectable.

33. Claim 23 is rejected for the same reasons set forth in the corresponding method in claim 10.

34. Claims 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park as applied to claim 1 and 14 above, respectively, and further in view of Sittler, R.W., "An Optimal Data Association Problem in Surveillance Theory," IEEE Transactions on Military Electronics, Vol. 8 Issue 2, pp. 125-139 (published April 1964, hereinafter Sittler).

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35. With respect to claim 11, Park discloses the limitations of claim 1, but does not disclose storing a new object model when a detected object does not match a current object model.

However, Sittler discloses the initiation of tracks during the course of monitoring a series of images, creating a new object model when a new object is detected (section IV.B.2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the technique of Park with the additional target tracking technique of Sittler, motivated by the desire to track new objects that arrive in the field of view.

36. Claim 24 is rejected for the same reasons set forth in the corresponding method in claim 11.

Conclusion

37. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chodos et al., U.S. Patent 4,849,906.

Fiala, H.E., U.S. Patent 5,109,435.

Haritaoglu, I., et al. (September 1999) "Hydra: Multiple people detection and tracking using silhouettes." Proc. 1999 Int'l. Conf. on Image Analysis and Processing, pp. 280-285.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barry Drennan whose telephone number is 571-270-7262. The examiner can normally be reached on Monday through Thursday and alternate Fridays from 8:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Abul Azad can be reached on 571-272-7599. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Barry Drennan/
Examiner, Art Unit 4133

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